

FROM REGIONAL NODE TO GLOBAL GATEWAY: PATHWAYS AND STRATEGIES FOR THE EAST-ORIENTED LINKAGE DEVELOPMENT OF HEFEI METROPOLITAN CIRCLE UNDER THE CONSTRUCTION OF SHANGHAI METROPOLITAN CIRCLE

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Abstract: Against the background of Shanghai Metropolitan Circle expanding toward the 1+13 spatial scope, Hefei Metropolitan Circle, as a newly approved national-level metropolitan circle, faces critical opportunities and challenges in realizing east-oriented linkage with the Yangtze River Delta core area. From the perspective of “harmonized-plate theory”, this paper identifies short-term and long-term bottlenecks restricting cross-border factor flow between Hefei and Shanghai metropolitan circles, and constructs an analytical framework covering theoretical mechanism, spatial pattern, industrialtechnological collaboration, institutional openingup and regional cultural coprosperity. Supported by CityGO intelligent simulation tool and multi-source big data monitoring for 41 cities in Yangtze River Delta, this research adopts interdisciplinary integration, case comparison and field investigation to diagnose existing barriers including administrative boundary segmentation, insufficient market-oriented allocation of cross-regional factors and inadequate soft connection of regional culture. The study puts forward the progressive logic of “heterogeneousplate complementarity—homogeneousplate alliance—heterogeneousplate coalition”, optimizes the “bowstring coordination” spatial layout along Hefei-Nanjing-Shanghai development axis, designs implementation pathways for the “Shanghai R&D + Hefei transformation” innovation pattern, and proposes institutional innovation schemes covering factor benefitsharing, policy mutualrecognition and cultural exchange. Findings can provide decisionmaking reference for Hefei Metropolitan Circle to transform from a regional functional node into an important global gateway of Yangtze River Delta, and offer practical experience for the highquality integration of largescale urbanregions in China.

Keywords: Shanghai Metropolitan Circle; Hefei Metropolitan Circle; East-Oriented linkage; Harmonized-plate theory; Urban regional integration; Factor flow; Cultural coprosperity

1 INTRODUCTION

With the evolution of mega urbanregions from administrative boundary governance to flow-space functional governance, Shanghai Metropolitan Circle has stepped into the 1+13 collaborative development phase driven by traffic accessibility, scientifictechnological innovation and ecological cogovernance [1]. The adjustment of spatial scope is not merely a geographical expansion, but represents a fundamental shift of regional governance logic: urban connection is no longer bounded by administrative divisions, but shaped by population mobility, industrial chain links, knowledge spillover and cultural interaction flows across cities [2]. As an emerging national-level metropolitan circle approved in 2024, Hefei Metropolitan Circle covers seven counties and districts centering on Hefei city [3]. Relying on its solid advanced manufacturing foundation, national major science infrastructure clusters, it aims to build an international innovation highland in centraleastern China. Nevertheless, Hefei still suffers from obvious energylevel gaps compared with Nanjing and Hangzhou metropolitan circles in East-Oriented interconnection; deep-seated institutional obstacles still restrain cross-provincial factor marketization reform, which impedes effective docking with core functional systems of Shanghai Metropolitan Circle.

Existing researches have produced abundant achievements for individual metropolitan circle planning. Scholars have discussed spatial boundary delimitation, industrial positioning and internal coordination mechanism for Shanghai Metropolitan Circle and Hefei Metropolitan Circle respectively [4, 5]. Zhang analysed the formation mechanism of Shanghai 1+13 functional circle based on traffic commute and innovation connection data, pointing out that functional boundary is dynamically changing rather than static administrative scope. Xiao illustrated the construction priorities for national-level metropolitan circles in Yangtze River Delta, emphasizing the importance of cross-provincial coordination mechanism construction [6]. However, research gaps remain in three key dimensions. First, targeted researches reexamining Hefei Metropolitan Circle’s capacity improvement within the large framework of Shanghai 1+13 metropolitan circle remain insufficient; most studies treat Hefei as an independent research object instead of placing it into the globaloriented functional network of Shanghai mega urbanregion. Second, refined institutional design targeting cross-provincial factor flow is relatively scarce; many policy suggestions stay at macro strategic level without operable schemes for land index adjustment, revenue sharing and talent mutual recognition across provincial boundaries. Third,

compound softward collaborative paths integrating industrial innovation with regional cultural communication are still lacking. Most existing studies overemphasize economic and infrastructure connection while ignoring local cultural resources such as Huizhou ecological wisdom, which can reduce crosscity collaborative transaction costs and build regional identity consensus as soft bonding force for metropolitan integration [7].

Urbanregional collaboration theory originates from Gottmann's classical research on megalopolis, which reveals that closely connected population and economic activities constitute integrated urban agglomeration systems across administrative boundaries [8]. Domestic scholars have divided Yangtze River Delta regional governance into rigid governance dominated by administrative adjustment and flexible governance represented by jointconference mechanisms, pointing out that pure administrative adjustment cannot solve cross-provincial coordination dilemmas in the new development stage [9]. Intelligent planning theories supported by bigdata and artificial intelligence provide new technical approaches for identifying flow-space characteristics and realizing closedloop dynamic governance of urbanregions, making quantitative assessment of crossadministrativebarrier effects feasible [10, 11]. Newquality productive forces require reasonable spatial layout taking metropolitan circles as major carriers, which further raises practical demands for Hefei to realize East-Oriented linkage and undertake high-end innovation resources from Shanghai Metropolitan Circle [12]. Apart from hard factors such as land, capital and talent, local cultural mutual learning and cross-regional cultural communication serve as important soft foundations reducing collaborative transaction costs among cities, which cannot be ignored in metropolitan circle integration construction [7, 13].

This paper follows the complete research logic of 'current situation measurementproblem diagnosis path designstrategy formulation'. Firstly, it evaluates collaborative health status of two metropolitan circles based on urbanorganism theory; secondly, it diagnoses practical obstacles caused by administrative segmentation slowing cross-border factor flows; thirdly, it designs differentiated East-Oriented linkage paths for Hefei Metropolitan Circle embedding into Shanghai global urbanregion, combining industrial innovation coordination with regional cultural coprosperity; finally, it forms policy reserves and action plans oriented toward China's 15th FiveYearPlan period. The research attempts to answer two core research questions:

- (1) What are the multidimensional bottlenecks restricting Hefei Metropolitan Circle's East-Oriented integration into Shanghai Metropolitan Circle under flow-space perspective?
- (2) How can Hefei Metropolitan Circle break administrative barriers, give play to advantages of innovation and local culture, and realize transformation from a regional node to a global gateway under Shanghai Metropolitan Circle construction background?

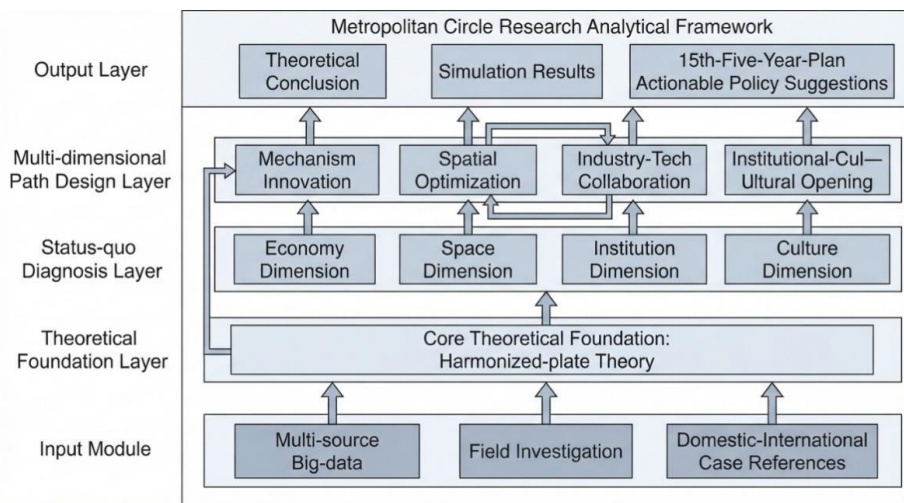


Figure 1 Overall Analytical Framework of the Research

2 THEORETICAL FRAMEWORK AND RESEARCH DESIGN

2.1 Theoretical Foundation: Extended Harmonized-plate Theory for Metropolitan Circle Linkage

The "harmonized-plate theory" is extended from existing urban agglomeration innovation research to metropolitan circle collaborative domain. This study puts forward a threestage progressive evolution logic including heterogeneousplate complementarity, homogeneousplate alliance and heterogeneousplate coalition (Figure 1).

Heterogeneousplate complementarity focuses on identifying longboards and shortboards among different cities within mega urbanregions. Shanghai holds longboard advantages in original innovation, high-end service and global cultural influence, while Hefei owns prominent strengths in achievement transformation, advanced manufacturing and local Huizhou cultural resources. Heterogeneousplate complementarity emphasizes that cities should avoid lowlevel homogeneous competition and realize resource matching according to respective comparative advantages.

On this basis, homogeneousplate alliance pushes cities with similar industrial foundation to jointly build industrial chains and innovation platforms, realize risk sharing and scale effect enhancement for strategic emerging industries such as integrated circuits and newenergy vehicles.

The final stage, heterogeneous plate coalition, targets systematic institutional arrangement for cross-border benefit-sharing, covering market-oriented factor allocation, industrial interest distribution and public service integration reform paths. Throughout these three progressive stages, regional cultural exchange continuously acts as important adhesive for plate coordination. Inheritance and cross-region communication of Huizhou-style local ecological wisdom can strengthen identity foundation for cross-city cooperation of Hefei toward Shanghai Metropolitan Circle, lowering institutional negotiation costs in plate coalition progress [7].

2.2 Research Content System

Four core research modules are constructed to respond to research questions raised above.

- (1) Theoretical foundation and mechanism design: recognize long-short boards by harmonized-plate theory, construct “longboard complement shortboard, heterogeneous plate build alliance” linkage mechanism; study institutional reform paths of cross-regional factor marketization, industrial collaboration benefit sharing and public service integration.
- (2) Spatial pattern and traffic network: analyze spatial restructuring effect of hub railways such as Shanghai-Nanjing-Hefei-Wuhan high-speed railway on regional flow pattern; explore “bowstring coordination” spatial mode and optimize Hefei-Nanjing-Shanghai development axis layout, clarify positioning of county-level nodal cities along the axis. With the continuous operation of multiple high-speed rail lines, time-distance compression reshapes the accessibility pattern among Yangtze River Delta cities, which provides essential precondition for Hefei’s East-Oriented functional connection [14].
- (3) Industrial collaboration and scientific technological innovation: focus on new energy vehicles, artificial intelligence and integrated circuit industries which are strategically vital for Yangtze River Delta; construct “Shanghai R&D + Hefei transformation” pattern, analyze innovation resource undertaking strategies under G60 SciTech Corridor capacity expansion background [15].
- (4) Institutional opening up and cultural coprosperity: replicate pilot experience from free trade zones, build international business environment; explore cross-provincial policy coordination, standard mutual recognition and innovative investment cooperation; bring regional cultural inheritance and cross-border communication into intercity cooperation mechanisms to consolidate soft foundation for cross-regional linkage [16].

2.3 Research Methods

Three mixed research methods are adopted conforming to EI urban regional research paradigm, combining qualitative theoretical analysis, big data quantitative simulation and empirical field investigation.

- (1) Interdisciplinary integration: integrate theories from urban planning, regional economics, public administration and traffic engineering. Regional linkage of metropolitan circle involves spatial layout, industrial interest game, public policy design and transportation accessibility evaluation, which cannot be solved by single discipline. The research team accumulates practical planning experience from Yangtze River Delta ecological green integration demonstration zone and Taihu Bay SciTech innovation belt, providing solid disciplinary support for mechanism analysis.
- (2) Intelligent technology empowerment: apply big data analysis and artificial intelligence, build evaluation index system for urban innovation capacity covering innovation input, transformation efficiency and industrial output dimensions [10,11]. The research conducts dynamic monitoring and intelligent allocation simulation for 41 cities within Yangtze River Delta based on CityGO tool and iCity concept developed by Wu Zhiqiang’s research group, as well as global largest urban dynamic database containing more than 13 thousand cities and long time sequence multidimension indicators. Artificial intelligence simulation helps quantify the hindrance effect of administrative boundaries on innovation element spillover, overcoming the defect of pure qualitative judgment in traditional regional research [10, 11]. In this study, we set multi-scenario simulation groups: baseline scenario without institutional reform, factor market-oriented reform scenario, factor culture synergy scenario. Simulation output contrasts the innovation spillover intensity under different scenarios, providing quantitative evidence for policy design.
- (3) Case comparison and field investigation: carry out experience comparison among international metropolitan circles (New York, Tokyo, Paris) and domestic typical cases (Guangdong-Hong Kong-Macao, Shenzhen-Dongguan-Huizhou, Suzhou-Wuxi-Changzhou). For international cases, New York Metropolitan Region provides reference for cross-state benefit sharing governance; Tokyo-Yokohama metropolitan area shows how core periphery realize innovation achievement transformation through multi-level nodal system [17]; Paris-Ile-de-France case reveals the value of regional cultural coordination for megaregion integration. Domestic cases offer practical experience for cross-provincial benefit distribution [18]. Field investigations are implemented covering 7 counties and districts of Hefei Metropolitan Circle and correlated cities of Shanghai Metropolitan Circle; the team draws on practical experience from local planning projects in Feixi County “Three-Zones-One-Belt” to guarantee the practicability of research conclusion. More than 30 semistructured interviews are conducted with local planning administrators, enterprise R&D managers and cultural heritage workers during field research. Interview topics include cross-provincial project cooperation obstacles, innovation resource docking difficulties, and the current status of Huizhou cultural cross-city communication (Figure 2).

2.4 Research Emphasis and Difficulties

The research emphasis lies in exploring solutions for market-oriented obstacles of cross-provincial factor flow, especially institutional breakthrough on overall utilization of construction land indicators and cross-regional benefit distribution

mechanism [19]. Apart from hard institutional design, this study also emphasizes constructing soft collaborative channels through regional cultural mutual learning and communication, to reduce intercity cooperation friction caused by administrative and cognitive differences.

The main difficulty comes from quantitative evaluation of cross-regional synergy mechanism. On one hand, how to adopt AI simulation to identify substantial impacts brought by administrative barriers on innovation chain, and separate the influence of administrative segmentation from traffic distance and economic gap factors. On the other hand, it is challenging to design matched benefit compensation mechanism considering both industrialeconomic benefits and cultural publicgoods supply across administrative boundaries. Cultural cooperation output is mostly nonmonetary public goods, which brings difficulty for quantitative measurement of collaborative gains.

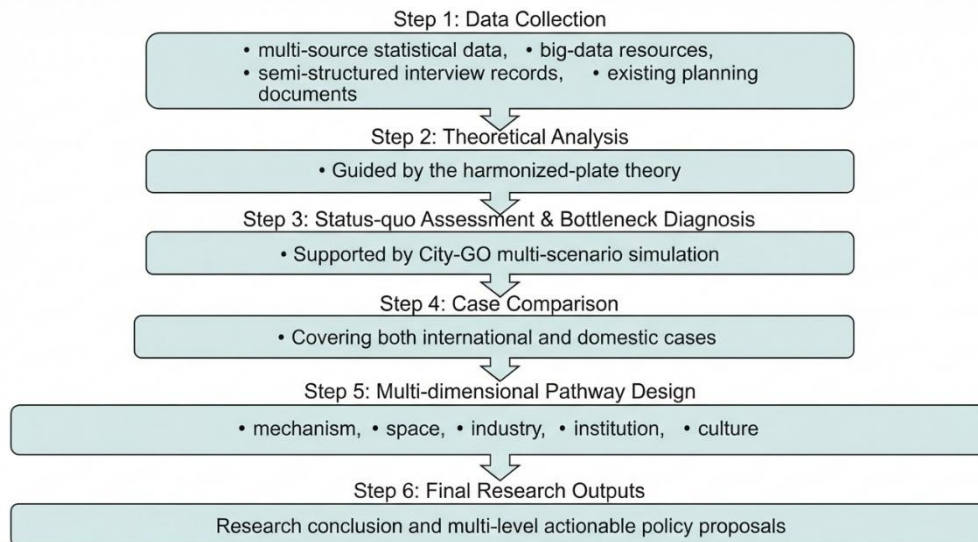


Figure 2 Technical Roadmap of the Research

3 CURRENTSITUATION DIAGNOSIS AND CORE VIEWPOINTS

3.1 Statusquo and Restriction Factors of East-Oriented Linkage

Shanghai Metropolitan Circle completes paradigm transformation from original “1+8” to “1+13”, its core city Shanghai’s radiation effect keeps strengthening, and citycity relations have transferred from zerosum competition to winwin coopetition, which relies heavily on long-term benefit-sharing consensus mechanism construction [1,4,5]. Under the promotion of high-speed-rail network, Hefei Metropolitan Circle accelerates twoway connection with Hangzhou through ShangqiuHefeiHangzhou highspeed railway axis to build HangzhouHefei innovation belt, and initial achievements have been obtained in undertaking part of manufacturing transfer from eastern Yangtze River Delta cities [14, 15]. According to multi-source big data monitoring results for Yangtze River Delta 41 cities, Hefei’s innovation output ranking keeps rising in recent years, yet its intercity connection intensity with Shanghai is lower compared with Suzhou, Wuxi and Changzhou. The connection gap is not totally caused by geographical distance; institutional barrier is another critical influencing factor [17, 19].

Nevertheless, multiple bottlenecks still constrain Hefei’s East-Oriented linkage toward Shanghai Metropolitan Circle. First, cross-provincial administrative segmentation hinders efficient factor flow [17, 19]. Land index allocation, talent household registration, social security mutualrecognition still belong to provincial jurisdiction scope; cross-regional “one factory across two regions” cooperation mode faces practical obstacles in revenue distribution and assessment mechanism design [18, 19]. Second, innovation chain cooperation remains at primary docking stage. Although Hefei has strong manufacturing transformation capacity, the depth of joint research and development with Shanghai high-end research institutions needs further improvement; spillover channels of original innovation achievements are not smooth enough under G60 SciTech Corridor background [15]. Third, spatial connection efficiency of peripheral nodal cities is insufficient. County-level units within Hefei Metropolitan Circle are not fully integrated into ShanghaiNanjingHefei development axis; some smallandmedium nodes lack clear functional positioning in mega urbanregion network. Fourth, soft cultural linkage lags behind hard infrastructure construction. Huizhou local ecological wisdom and cultural heritage lack effective cross-border communication carrier between Hefei and Shanghai Metropolitan Circle; hard economic linkage has not formed good coupling with soft cultural collaboration, and cultural resources have not been fully converted into regional collaborative competitive advantage [7, 13]. The simulation result of CityGO tool shows that under baseline scenario without institutional reform, administrative barriers will reduce about 21% of cross-provincial innovation spillover effect between Shanghai and Hefei.

3.2 Basic Viewpoints

(1) The essence of East-Oriented linkage for Hefei Metropolitan Circle is cross-regional harmonized-plate adaptation of innovation and cultural resources. Breaking traditional centerperiphery thinking originated from early global cityregion research, Hefei should not passively accept industrial transfer from core cities [20]. Instead, it is necessary to build a new collaboration paradigm based on dual complementarity of hard production factors and soft regional culture, give play to its comparative advantages in advanced manufacturing, major scientific devices and Huizhou cultural resources, and realize mutual benefit rather than oneway receiving of resources.

(2) Digitalintelligent spatial analysis serves as key technical support for precise cross-provincial metropolitan collaboration. AI-driven multi-scenario deduction, intelligent optimization and dynamic evaluation promote urbanregional planning transforming from empirical mode to scientific engineering [10, 11]. CityGO and related simulation tools can realize quantitative assessment for both industrialeconomic benefits and cultural collaborative effect of East-Oriented linkage projects, providing objective evidence for cross-regional policy making.

(3) Realizing transformation from regional node to global gateway requires joint progress of hard system reform and soft cultural construction. Global gateway is not merely reflected in traffic and logistics hub capacity; it also includes functions of undertaking global innovation resources and exporting regional cultural influence [21, 22]. Only combining institutional innovation of factor marketization with cross-regional cultural coprosperity can Hefei Metropolitan Circle acquire stable competitive position within Shanghai mega urbanregion network.

4 PATHWAYS AND STRATEGIES FOR EAST-ORIENTED LINKAGE DEVELOPMENT

This section puts forward multi-level strategies, dividing into mechanism layer, spatial layer, industryinnovation layer and institutionalopening layer. Each dimension includes long-term strategic orientation and shortterm operable measures.

4.1 Mechanism Innovation: Build Harmonized-plate Collaborative System Oriented Toward Factorculture Joint Complementarity

Implement progressive logic of “heterogeneousplate complementarity—homogeneousplate alliance—heterogeneousplate coalition”. On the factor dimension, promote market-oriented allocation reform of cross-regional land, talent and capital, explore benefitsharing mode such as crossdistrict constructionland indicator adjustment and “one factory across two regions” [18, 19]. Establish special negotiation platform for cross-provincial benefit distribution, formulate quantitative revenue allocation rules for cross-border industrial projects, solve interest game obstacles between different administrative subjects [16, 19]. Drawing lessons from the practice of SuWuxiChangzhou metropolitan cooperation, set up special fund for cross-regional collaborative compensation, to make up for the loss of local fiscal revenue in undertaking industrial projects.

On the cultural dimension, launch joint research and communication projects of Huizhou cultural heritage and Yangtze River Delta urban culture, set up crosscity cultural exchange platform jointly sponsored by Shanghai, Nanjing and Hefei. Take local ecological wisdom as important soft resources of metropolitan circle cooperation; support joint holding of exhibitions, heritage research and creative product development projects themed on Huizhou culture, consolidate identity foundation for cross-provincial collaboration [7, 13, 23]. Cultural cooperation should be formally incorporated into regular agenda of intercity joint conference system, so that soft collaborative mechanism can obtain institutional guarantee instead of being limited to occasional nonofficial activities [9, 16].

4.2 Spatial Optimization: Shape “Bowstring Coordination” Pattern along Hefei-Nanjing-Shanghai Development Axis

Give full play to spatial restructuring effect of major high-speed-rail corridors including Hefei-Nanjing-Shanghai highspeed railway, Shangqiu-Hefei-Hangzhou railway and Shanghai-Nanjing-Hefei-Wuhan railway [14]. Optimize the layout of Hefei-Nanjing-Shanghai development axis, construct multi-level node system for Hefei Metropolitan Circle. Strengthen connection between county-level units of Hefei Metropolitan Circle and peripheral nodes of Shanghai Metropolitan Circle; assign differentiated functional positioning for different nodal cities along the axis according to their resource endowment. For example, Chaohu undertakes ecological and leisure collaborative functions; Feixi focuses on advanced manufacturing docking; Feidong acts as logistics and innovation transformation node.

Combine spatial planning with cultural facility layout: arrange cross-regional cultural exhibition and innovation experience nodes along main traffic corridors. Relying on high-speed-rail station area, build cultural and innovation complex carrying Huizhou cultural display, sciencetechnology achievement display and industry incubation functions, realize organic integration of material element spatial flow and intangible cultural communication flow. Under “bowstring coordination” spatial pattern, the Hefei-Nanjing-Shanghai main development axis acts as the string; multiple secondary cross-regional cooperation corridors act as bow arcs, forming multidirectional and multi-level connection system instead of single linear connection mode.

4.3 Industrialinnovation Collaboration: Realize “Shanghai R&D + Hefei Transformation” under G60 SciTech Corridor

Focus on newenergy vehicles, artificial intelligence and integratedcircuit strategic industries of Yangtze River Delta. Hefei takes advantage of complete manufacturing capacity and major scientific infrastructure conditions to undertake

original innovation outcomes from Shanghai. Promote deep docking between Shanghai top research institutes and Hefei local enterprises; support setting up of joint laboratories and achievement transformation centers located in Hefei with Shanghai intellectual support. Expand resource undertaking channels under the background of G60 SciTech Corridor capacity expansion; improve the intellectual property right benefit distribution mechanism for cross-city joint R&D projects, fully protect interests of Shanghai R&D institutions and Hefei transformation entities [15].

Support joint establishment of industrial innovation platforms, encourage co-construction of industrial culture integration projects. For strategic emerging industries, carry out homogeneous plate alliance cooperation: cities with similar industrial foundation jointly formulate technical standards, share large-scale scientific research equipment, jointly respond to global industrial chain risks. In the collaboration process, realize joint promotion of industrial chain value and regional cultural influence; develop cultural creative products based on advanced manufacturing technology and Huizhou cultural elements, expand the international influence of Yangtze River Delta local culture.

4.4 Institutional Opening-up Strategy: Improve Cross-regional Policy Coordination and Multisubject Cooperation Mechanism

Draw experience from free trade zone pilot reform, jointly build world-class international business environment within Shanghai-Hefei linked region. Promote mutual-recognition of cross-provincial standards in market access, talent qualification and public service; innovate investment cooperation mode, perfect benefit-sharing mechanism for cross-regional projects [16-19]. Encourage multisubject participation including governments, enterprises, universities and social organizations, avoid overreliance on administrative top-down promotion [16, 17]. Divide policies into three tiers: strategic guiding policy for medium and long term, annual implementation action, special pilot project for typical cross-border cooperation zones.

Bring cultural cooperation into intercity joint conference formal agenda. Encourage universities, museums and social organizations to carry out cross-regional cultural communication activities; support cross-regional cooperation projects on cultural heritage protection, digital cultural resource development and cultural tourism joint development [7, 13, 22, 23]. Form comprehensive institutional system covering economy, science and technology and culture for East-Oriented linkage of Hefei Metropolitan Circle. Through multidimensional institutional innovation, support Hefei to accomplish the transformation from regional functional node to important global gateway of Yangtze River Delta mega urban-region [20-22].

5 CONCLUSION

Under the construction background of Shanghai Metropolitan Circle, Hefei Metropolitan Circle faces important strategic opportunities to realize East-Oriented linkage and embed into global urban regional network. Relying on extended harmonized-plate theory, this research constructs multidimensional analytical framework including mechanism design, spatial layout, industrial innovation collaboration as well as institutional and cultural coordination. Supported by big data monitoring, City-GO intelligent multi-scenario simulation and onsite field investigation, this paper diagnoses that administrative segmentation, insufficient market-oriented factor allocation and insufficient soft connection of regional culture are major bottlenecks restricting Hefei's East-Oriented development. Simulation output demonstrates that factor-culture synergistic reform scenario can effectively lift cross-provincial innovation spillover level compared with baseline scenario.

Only by constructing progressive harmonized-plate collaborative system integrating factor allocation and cultural coprosperity, optimizing bowstring coordination spatial pattern along Hefei-Nanjing-Shanghai axis, promoting "Shanghai R&D + Hefei transformation" innovation pattern under G60 SciTech Corridor, and perfecting institutional innovation integrating economic cooperation with cultural mutual learning, can Hefei Metropolitan Circle effectively break administrative barriers, give play to advantages of advanced manufacturing and local Huizhou cultural resources, and achieve the expected transformation from regional node to global gateway within Yangtze River Delta mega urban region. For practical policy, research outcomes can provide decision support for Hefei Metropolitan Circle territorial spatial planning and the 15th Five-Year Plan policy reserve, supply argument basis for comprehensive reform pilot of factor market-oriented allocation, and offer referential experience for high-quality integrated development of large-scale urban regions in China. For theoretical exploration, this paper expands harmonized-plate theory's application scope in metropolitan circle research, verifies the value of AI-driven intelligent simulation in cross-provincial urban-region research, and supplements empirical evidence for the soft collaborative effect of regional cultural communication in metropolitan circle integration construction.

There still exist limitations in current study. Restricted by data accessibility, the quantitative measurement for coupling relationship between factor flow and cultural communication effect is relatively preliminary; cultural benefit is hard to be fully quantified by existing indicators. In future research, we will collect more granular cross-border project data, carry out more granular multi-scenario simulation analysis for typical cross-provincial cooperation projects, further improve operability of relevant policy suggestions. In addition, follow-up work can conduct comparative study between Hefei and other central China metropolitan circles, so as to generalize research conclusions.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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